

SRS Tank 51 Aluminum Leaching



We Put Science To Work

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Introduction

- Increased sludge mass estimates revived interest in aluminum dissolution process to reduce DWPF canisters.
- Flowsheet developed for low temperature process to dissolve gibbsite form of aluminum.
 - Previous characterization indicated primarily gibbsite form of Al
 - Avoids expensive tank ventilation upgrades
- SRNL tasked with demonstrating the proposed flowsheet on sample from Tank 51H

Aluminum Dissolution Test Plan

- A 3 L sludge sample obtained from Tank 51H - May 2007
- Characterized sludge sample
- Test Conditions
 - Conducted at 55 °C with agitation
 - Add 50 wt% NaOH to provide
 - Initial OH concentration of 4.3 M
 - 5:1 molar ratio of OH to Al
- Test duration of 21 days-sample periodically
- Settle sludge and decant (characterize both phases)
- Sludge washing and DWPF processing demonstration will also be conducted on sample

Tank 51H Sludge Composition

Major components of Tank 51H
Sludge as wt% of total dried solids

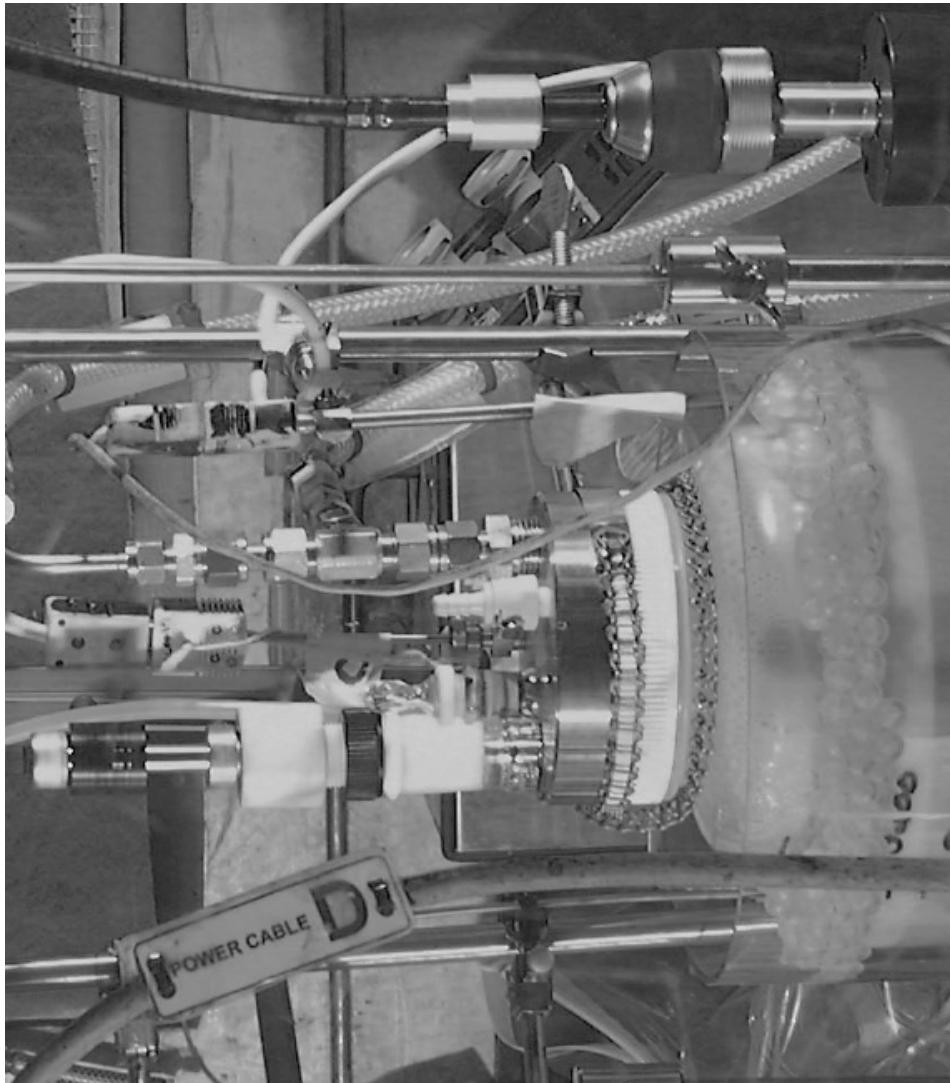
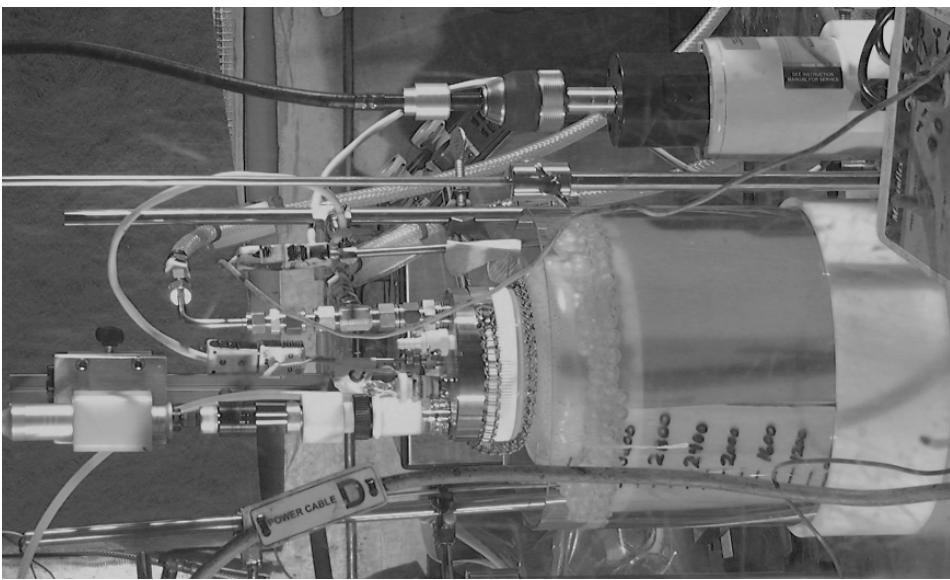
Analyte	Average Wt%
Al	15.6
Na	14.5
Fe	7.4
Mn	1.7
Hg	1.7
U	1.5
Ni	0.6
Si	0.4
Mg	0.3
Cr	0.04

Tank 51H Supernate

Analyte	Average M
Na	1.05
Al	0.013
Cr	7E-04
OH ⁻	0.032
NO ₃ ⁻	0.29
NO ₂ ⁻	0.49
SO ₄ ²⁻	0.03
C ₂ O ₄ ²⁻	0.003

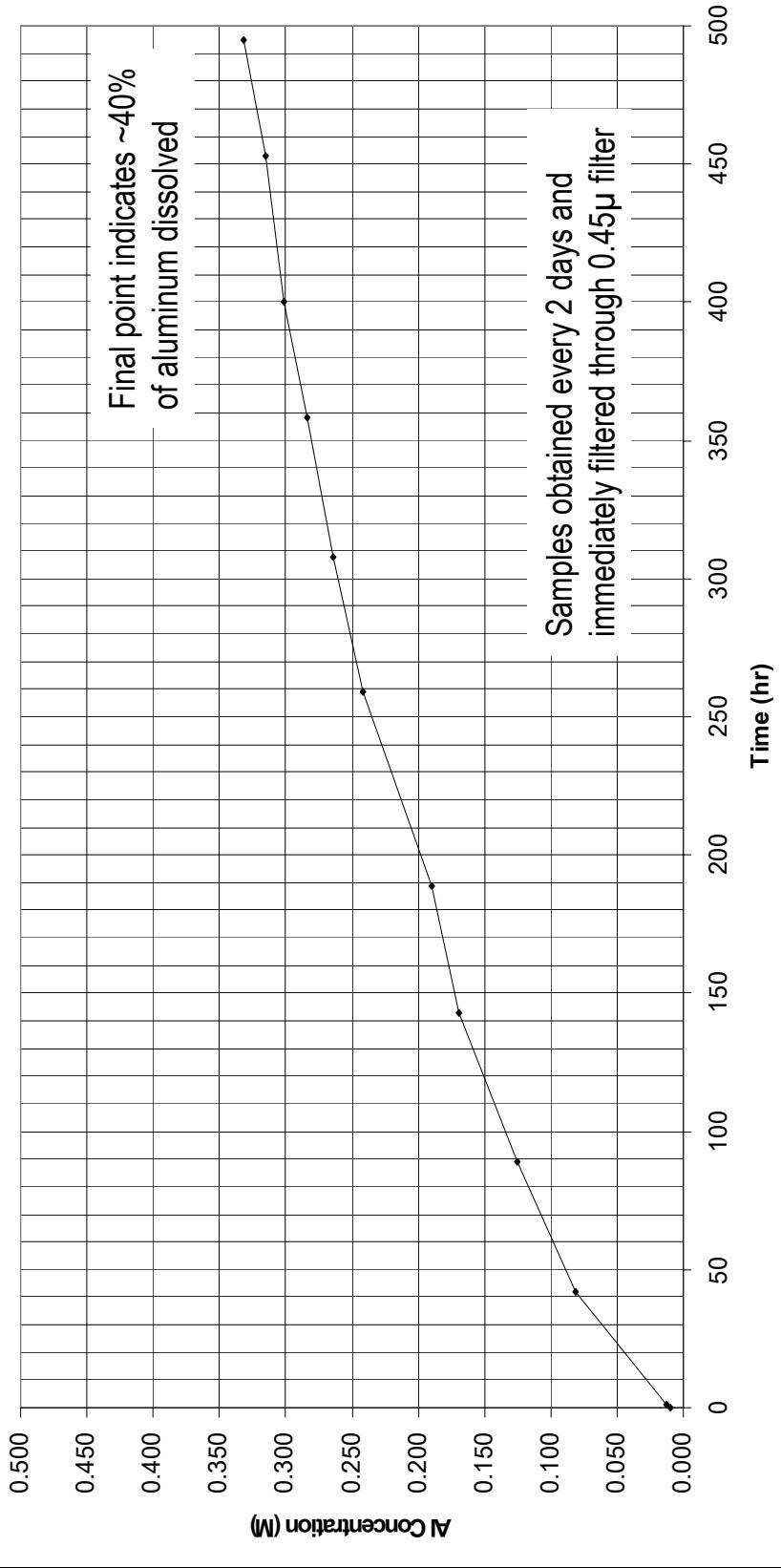
Tank 51H Sludge composition at 15.5 wt% total dried solids

Tank 51H Aluminum Dissolution



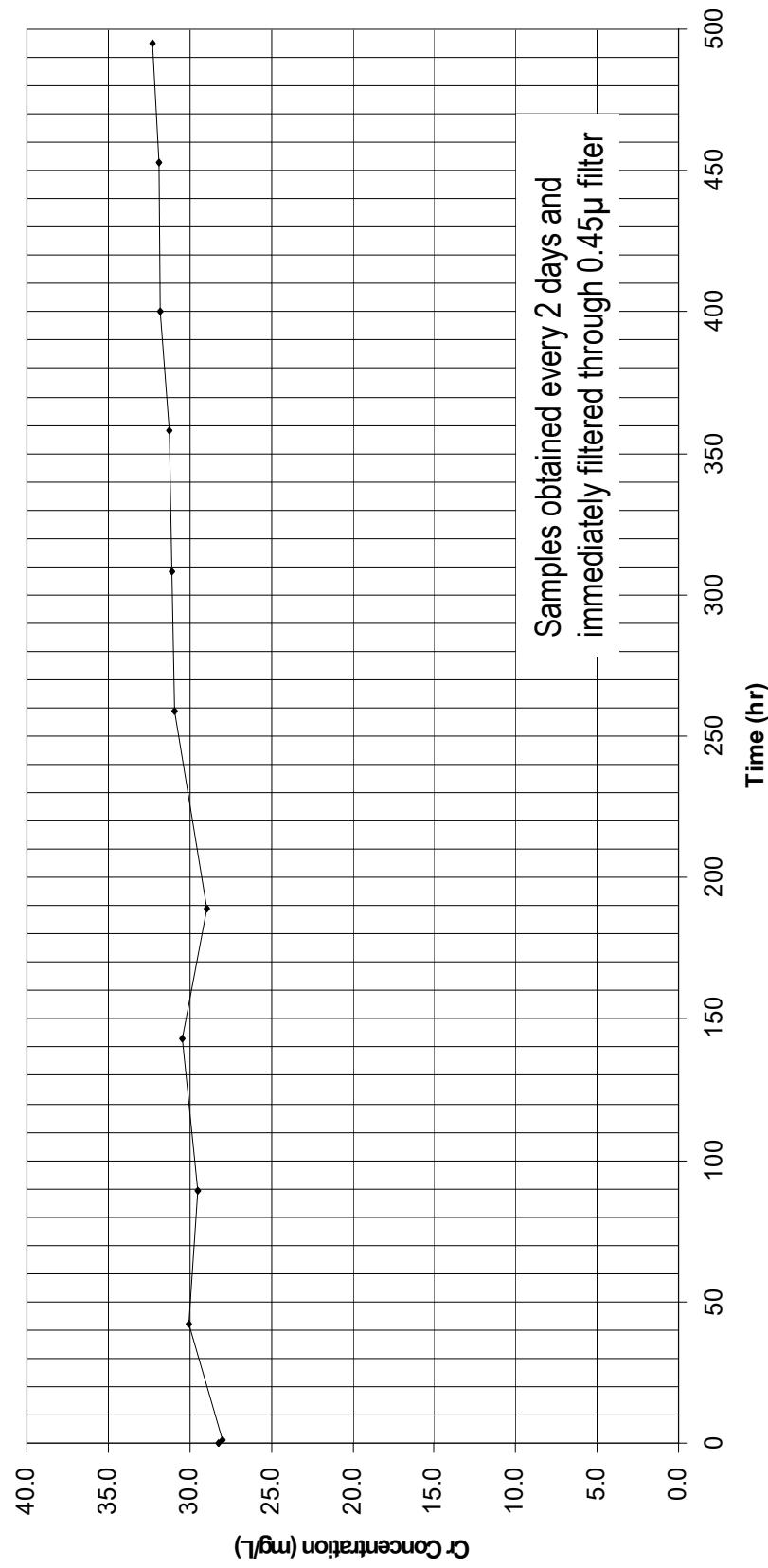
Tank 51H Aluminum Dissolution

Samples from 3 L Aluminum Dissolution Test



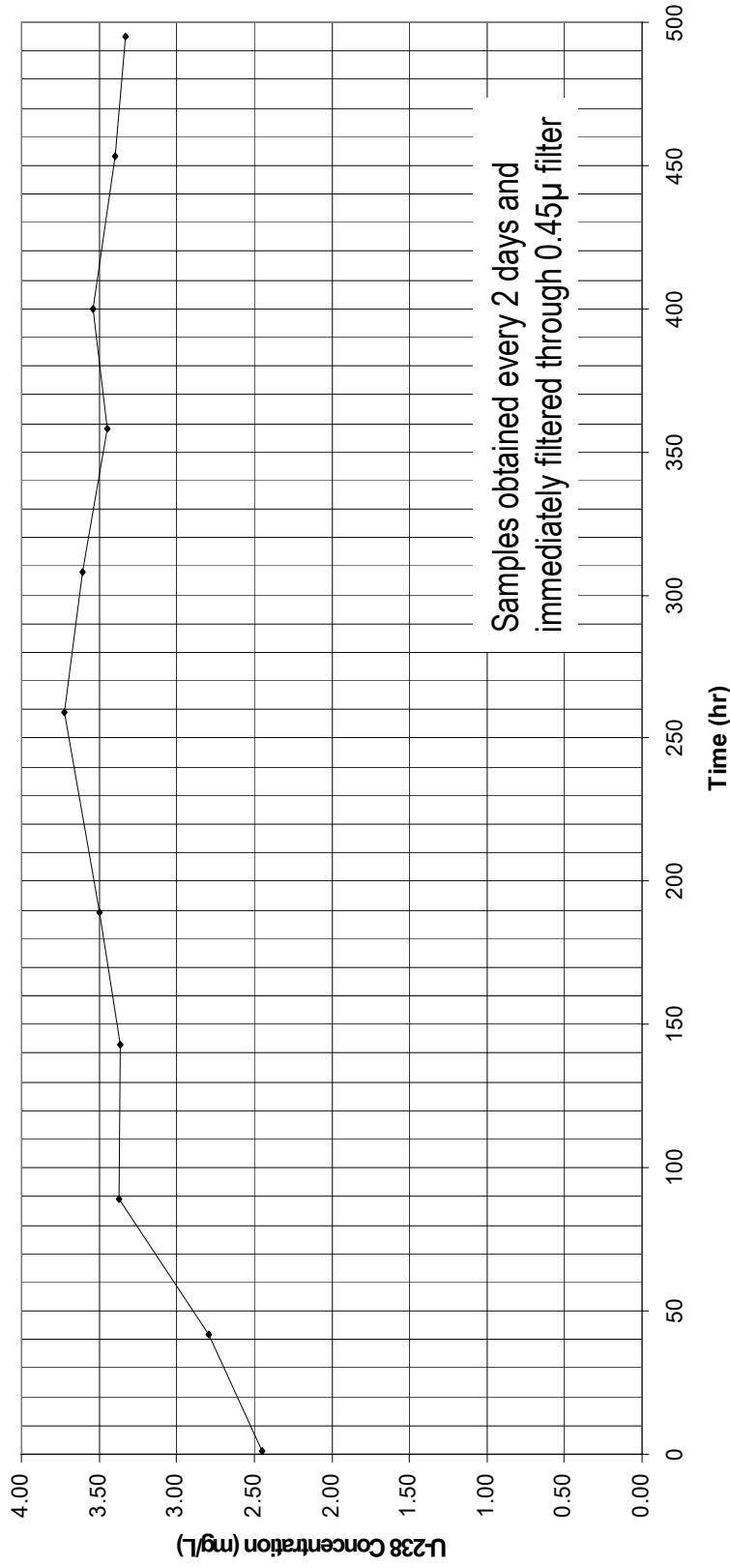
Tank 51H Aluminum Dissolution

Samples from 3 L Aluminum Dissolution Test



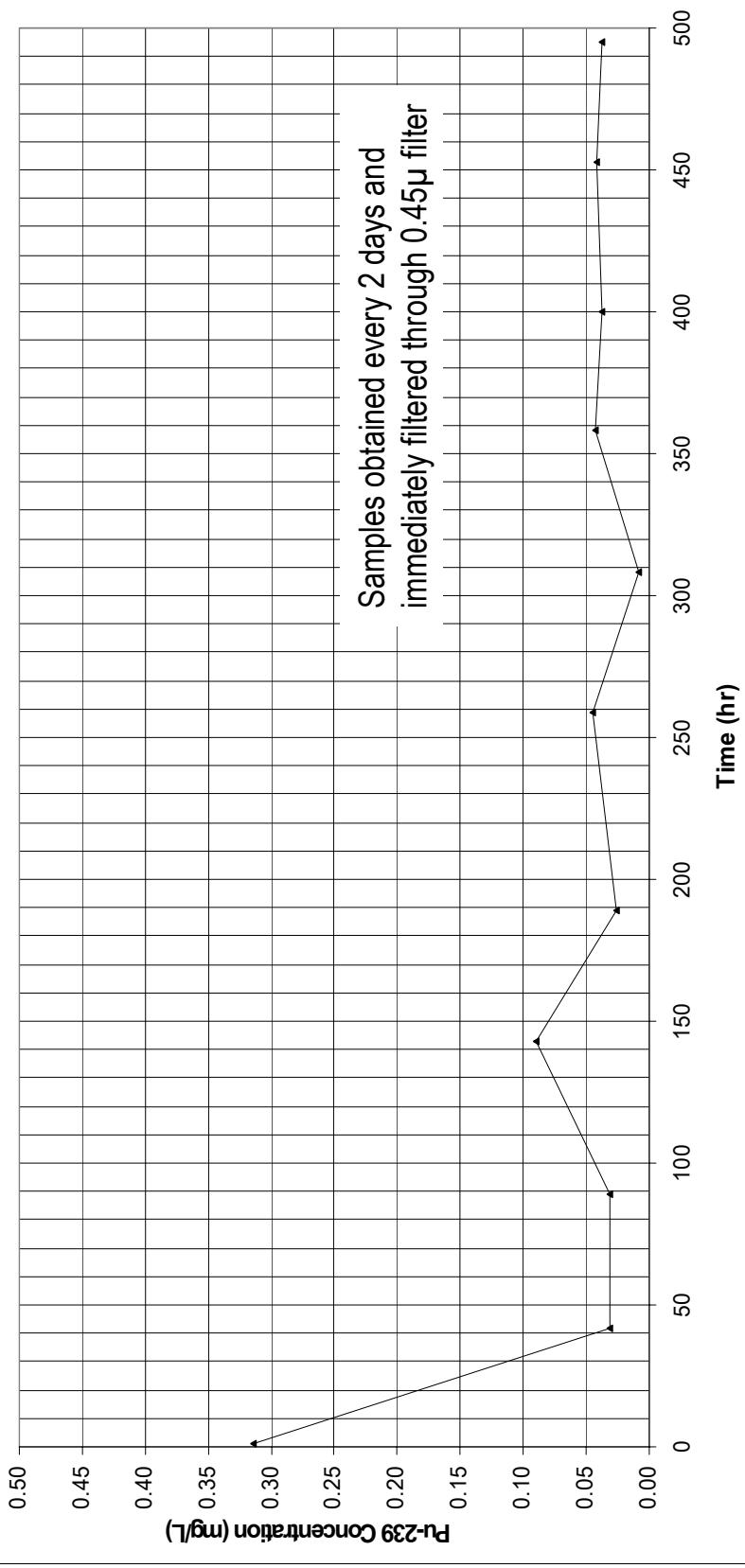
Tank 51H Aluminum Dissolution

Samples from 3 L Aluminum Dissolution Test

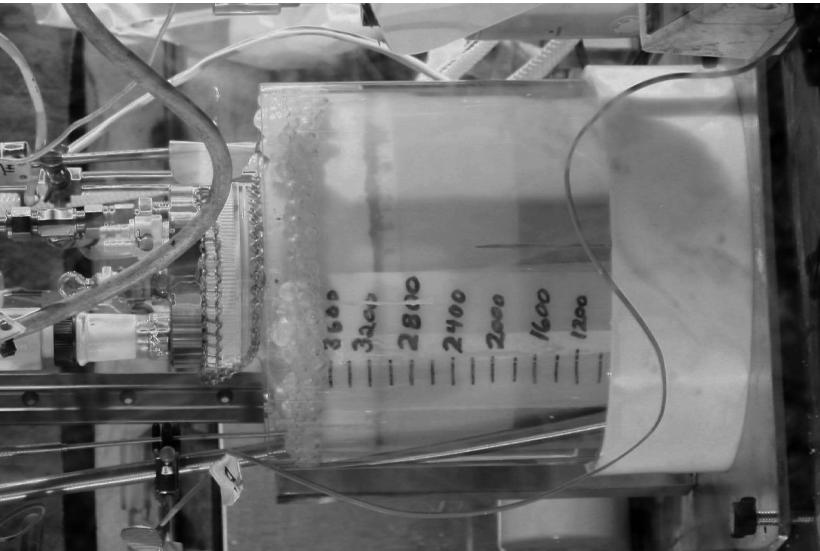


Tank 51H Aluminum Dissolution

Samples from 3 L Aluminum Dissolution Test



Tank 51H Sludge Settling



- At conclusion of aluminum dissolution the sludge is gravity settled
- Temperature maintained at 35 °C during settling
- Sludge appears to be settling “as expected” (i.e., no drastic change in settling behavior)

Post Dissolution Sludge Settling

Tank 51H Aluminum Dissolution Summary

- Based on the final Al concentration (0.33 M)
 - Approx 40% of Al in sludge dissolved (21 days @ 55 °C)
- No other major components of sludge dissolved (except U?)
- Some U may have dissolved - awaiting data
- Some Pu may have precipitated - awaiting data
- Graph of Al conc vs time indicates dissolution not complete
- Plant process may approach 60-65 °C, should increase rate

Tank 51H Aluminum Dissolution Summary

- Low temperature aluminum dissolution - viable process for dissolving gibbsite
- Settling behavior - no “discernable” changes
- Will be evaluating:
 - The stability of the decanted aluminum rich solution
 - Rheology of the sludge
 - Sludge washing
 - DWPF Processing

Contact Information

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